

WHAT IS CLAIMED IS

1 1. A touch screen digitizing system including a touch
2 screen unit including a first resistive sheet with opposed first
3 and second terminals and a second resistive sheet with opposed
4 third and fourth terminals, and an analog-to-digital converter
5 having ^a~~first and second~~ reference input ^{terminal}~~terminals~~, the
6 improvement comprising in combination:

7 (a) a first switch coupled between a first reference
8 voltage and the second terminal, and a second switch ^{connected directly}~~coupled~~
9 between the first terminal and a second reference voltage for
10 energizing the first resistive sheet;

11 (b) a third switch coupled between the first reference
12 voltage and the fourth terminal, and a fourth switch ^{connected directly}~~coupled~~
13 between the third terminal and the second reference voltage for
14 energizing the second resistive sheet; and

15 (c) switching circuitry for coupling an input of the
16 analog-to-digital converter to the third terminal while the first
17 resistive sheet is energized and the second resistive sheet is
18 not energized, and for coupling the input to the first terminal
19 while the second resistive sheet is energized and the first
20 resistive sheet is not energized.

1 2. A method of operating a touch screen digitizing system
2 including a touch screen unit including a first resistive sheet
3 with opposed first and second terminals and a second resistive
4 sheet with opposed third and fourth terminals and an analog-to-
5 digital converter having first and second reference input
6 terminals to provide full-scale calibration of the digital output
7 of the digital-to-analog converter to the full-scale analog
8 outputs of the first and second resistive sheets irrespective of
9 sharp variations in the resistances of the first and second
10 resistive sheets and associated switches, the method comprising:

11 (a) coupling a first switch between a first reference
12 A voltage and the second terminal, and ^{connecting} ~~coupling~~ a second switch ^{directly}
13 between the first terminal and a second reference voltage when
14 energizing the first resistive sheet and coupling a third switch
15 between the first reference voltage and the fourth terminal, and
16 ^{connecting} ~~coupling~~ a fourth switch ^{directly} between the third terminal and the
17 second reference voltage when energizing the second resistive
18 sheet; and

19 (b) connecting an input of the analog-to-digital
20 converter to the third terminal while the first resistive sheet
21 is energized and the second resistive sheet is not energized, and
22 connecting the input to the first terminal while the second
23 resistive sheet is energized and the first resistive sheet is not
24 energized.

1 3. A touch screen digitizing system including a touch
2 screen unit including a first resistive sheet with opposed x+ and
3 x- terminals and a second resistive sheet with opposed y+ and y-
4 terminals, and an analog-to-digital converter having first and
5 second reference input terminals, the improvement comprising in
6 combination:

7 (a) a first switch coupled between a first reference
8 A voltage and the x- terminal, and a second switch ^{connected directly} ~~coupled~~ between
9 the x+ terminal and a second reference voltage for energizing the
10 first resistive sheet;

11 (b) a third switch coupled between the first reference
12 A voltage and the y- terminal, and a fourth switch ^{connected directly} ~~coupled~~ between
13 the y+ terminal and the second reference voltage for energizing
14 the second resistive sheet; and

15 (c) switching circuitry for coupling an input of the
16 analog-to-digital converter to the y+ terminal while the first
17 resistive sheet is energized and the second resistive sheet is
18 not energized, and for coupling the input to the x+ terminal
19 while the second resistive sheet is energized and the first
20 resistive sheet is not energized.

1 4. The touch screen digitizing system of Claim 3 wherein
2 the first and third switches are N-channel MOS transistors, and
3 the second and fourth switches are P-channel MOS transistors.

1 5. The touch screen system of Claim 4 wherein each of the
2 N-channel transistors and each of the P-channel transistors has
3 an on channel resistance in the range of 5 to 50 ohms, and each
4 of the first and second resistive sheets has a resistance in the
5 range from 300 to 2000 ohms.

1 6. The touch screen system of Claim 5 including a
2 microprocessor and circuitry responsive to an initial touching of
3 the touch screen unit to generate control information
4 representative of control signals to be respectively applied to
5 the various gate electrodes of the P-channel transistors and the
6 N-channel transistors and to the switching circuitry and to a
7 convert input of the analog-to-digital converter.

1 7. The touch screen system of Claim 6 including a control
2 circuit coupled to receive the control information and, in
3 response thereto, generate the control signals and a convert
4 signal to be applied to the convert input.

1 8. The touch screen system of Claim 7 wherein the analog-
2 to-digital converter is a successive approximation analog-to-
3 digital converter including a CDAC, a comparator coupled to an
4 output of the CDAC, and a successive approximation register.

1 9. A method of operating a touch screen digitizing system
2 including a touch screen unit including a first resistive sheet
3 with opposed x+ and x- terminals and a second resistive sheet
4 with opposed y+ and y- terminals and an analog-to-digital
5 converter having ^a~~first and second~~ reference input terminals~~;~~ to
6 provide full-scale calibration of the digital output of the
7 digital-to-analog converter to the full-scale analog outputs of
8 the first and second resistive sheets irrespective of sharp
9 variations in the resistances of the first and second resistive
10 sheets and associated switches, the method comprising:

11 (a) coupling a first switch between a first reference
12 voltage and the x- terminal, and ^{connecting} ~~coupling~~ a second switch ^{directly} ~~between~~
13 the x+ terminal and a second reference voltage when energizing
14 the first resistive sheet and coupling a third switch between the
15 first reference voltage and the y- terminal, and ^{connecting} ~~coupling~~ a
16 fourth switch ^{directly} ~~between~~ the y+ terminal and the second reference
17 voltage when energizing the second resistive sheet; and

18 (b) connecting an input of the analog-to-digital
19 converter to the y+ terminal while the first resistive sheet is
20 energized and the second resistive sheet is not energized, and
21 connecting the input to the x+ terminal while the second
22 resistive sheet is energized and the first resistive sheet is not
23 energized.

ADD A₂

Add
B₂